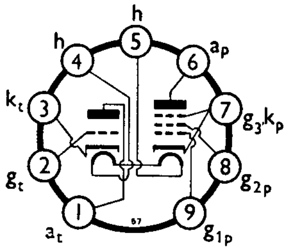
TRIODE PENTODE

0·3A INDIRECTLY HEATED

LN309

OCTOBER, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	22	mm.

RATINGS

I_h	0·3	A
V_h	12·6 approx.	V
$v_{h\,k\,(pk)}$	150 max.	V

PENTODE SYSTEM

Pentode connection

V_a		250 max.	V
V_{g2}		250 max.	V
p_a		5·4 max.	W
p_{g2}		1·2 max.	W
r_a	at $V_a = V_{g2} = 165$, $V_{g1} = -9$	45	kΩ
g_m		4·7	mA/V

Triode connection

V_{a+g2}		250 max.	V
p_{a+g2}		6·6 max.	W
μ	at $V_{a,g2} = 165$, $V_{g1} = -9$	9·5	
r_a		1·7	kΩ
g_m		5·6	mA/V

TRIODE SYSTEM

V_a		250 max.	V
p_a		3·5 max.	W
μ	at $V_a = 250$, $V_g = -8.5$	17	
r_a		7·7	kΩ
g_m		2·2	mA/V

CAPACITANCES

c_{gt-ap}	0·05	pF	c_{at-ap}	1·9	pF
c_{gt-g1p}	0·03	pF	c_{at-g1p}	0·12	pF
$c_{g1p-all}$ (less ap)	6	pF	c_{ap-all} (less g1p)	6·9	pF
c_{ap-g1p}	0·2	pF	c_{gt-kt}	1·7	pF
c_{at-kt}	0·3	pF	c_{at-gt}	1·5	pF

TYPICAL OPERATION

PENTODE SYSTEM. PENTODE CONNECTION.

A.F. amplifier. Class A. Single valve.

V_a	100	165	V
V_{g2}	100	165	V
$V_{g1\,(o)}$ approx.	−5	−8·4	V
$v_{g1\,(pk)}$	4	6·5	V
$I_{a\,(o)}$	20	32	mA
$I_{g2\,(o)}$	3	6	mA
R_k	220	220	Ω
R_L	5	6	kΩ
P_{out}	0·8	2·1	W
D	10	10	%

LN309

A.F. amplifier. Class AB1 push-pull. Two valves.

Data per pair unless otherwise stated.

V_a	165	200	V
V_{g2}	165	160	V
$V_{g1\ (o)}$ approx	−11·5	−11·5	V
$v_{g1\text{-}g1}$ (pk)	28	27	V
$I_{a\ (o)}$	46	46	mA
I_a (max. sig)	56	54	mA
$I_{g2\ (o)}$	6	6	mA
I_{g2} (max. sig)	12	11	mA
R_k	220	220	Ω
$R_{L\ (a\text{-}a)}$	6	6	kΩ
P_{out}	5·2	5·4	W
D	2·3	2·6	%

The external grid circuit resistance should be kept as low as possible and must not exceed 270kΩ+20% with auto bias, or 100kΩ+20% with fixed bias.

The application of this valve should be limited to normal broadcast receivers in which the average modulation does not exceed 40% on full drive ; otherwise the maximum screen grid dissipation will be exceeded.

TRIODE SYSTEM

A.F. amplifier. Class A.

V_a	165	200	V
V_g approx	−3	−4·3	V
$v_{g\ (pk)}$ (D=1%)	0·48	0·68	V
$v_{g\ (pk)}$ (D=2%)	1·04	1·33	V
$v_{out\ (pk)}$ (D=1%)	5·4	8·1	V
$v_{out\ (pk)}$ (D=2%)	12·5	16	V
I_a	1·1	1·3	mA
R_k	2·7	3·3	kΩ
R_a	100	100	kΩ
Gain	12	12	

CASCADE A.F. AMPLIFIER

Triode system driving pentode system

Single valve. Class A.

$V_{a\ (b)}$	177	V
V_{ap}	165	V
V_{g2p}	165	V
$V_{g1p\ (o)}$ (approx)	−9	V
V_{gt} (approx)	−3	V
v_{gt} (pk)	0·63	V
$I_{ap\ (o)}$	32	mA
$I_{g2p\ (o)}$	6	mA
I_{at}	1·1	mA
R_{Lp}	6	kΩ
R_{at}	100	kΩ
R_{kp}	220	Ω
R_{kt}	2·7	kΩ
P_{out}	2·1	W
D	10	%

MOUNTING

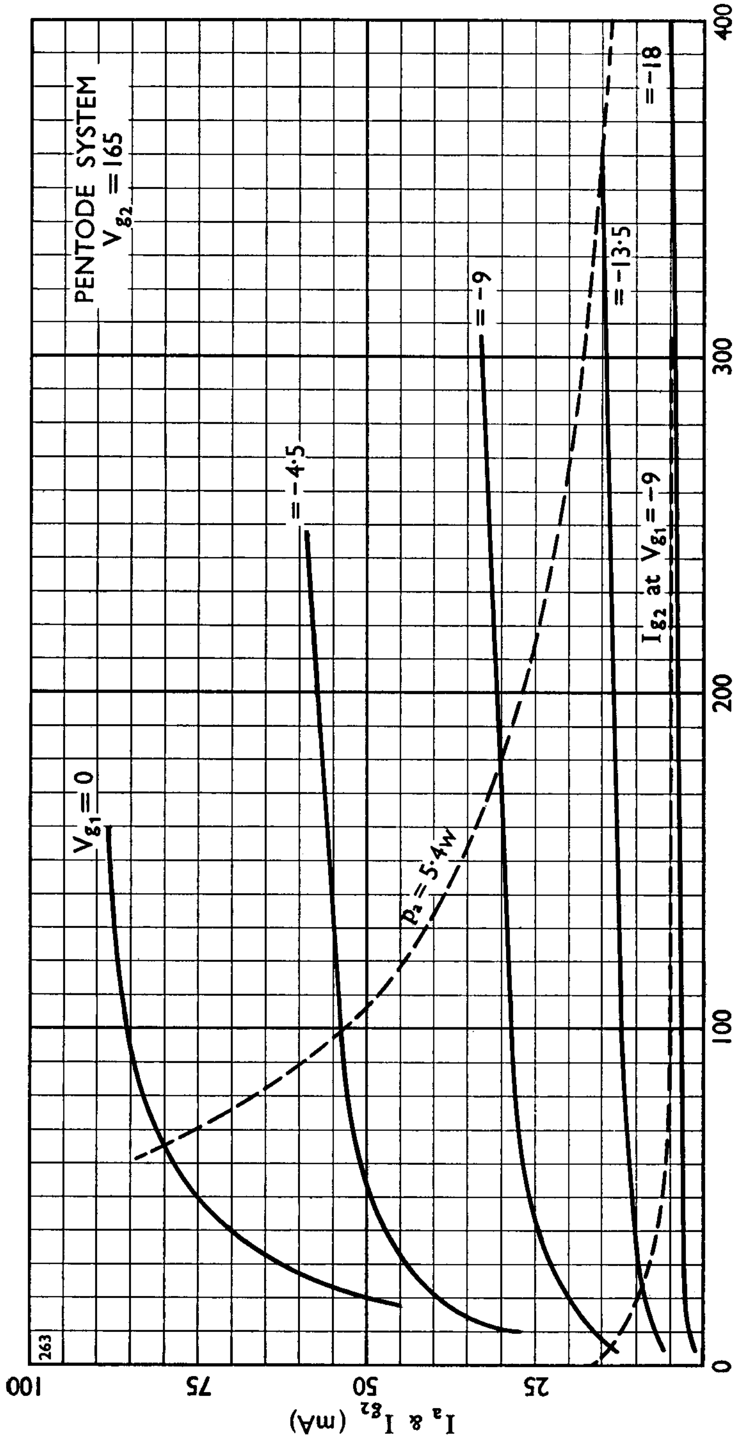
Any position.

SCREENING

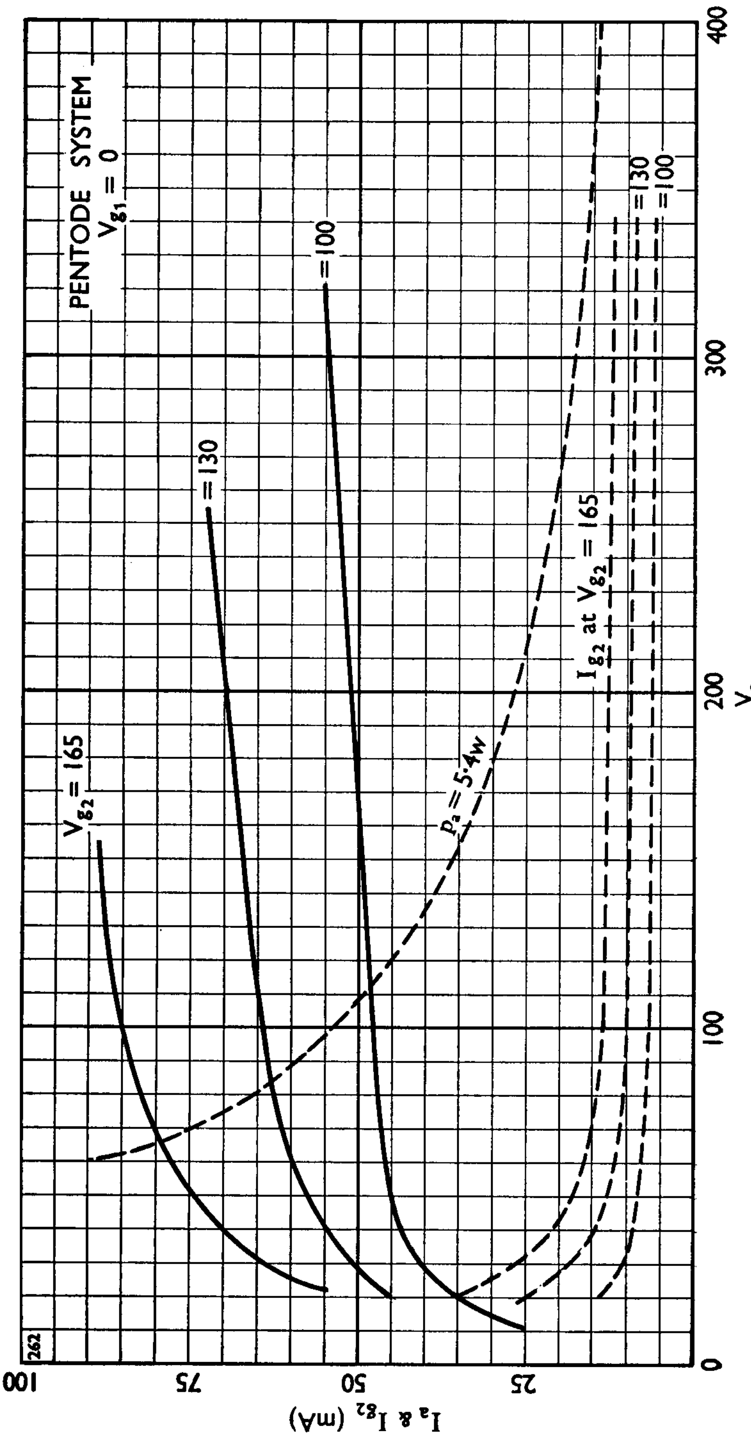
No internal or external screening is fitted to the valve.

VENTILATION

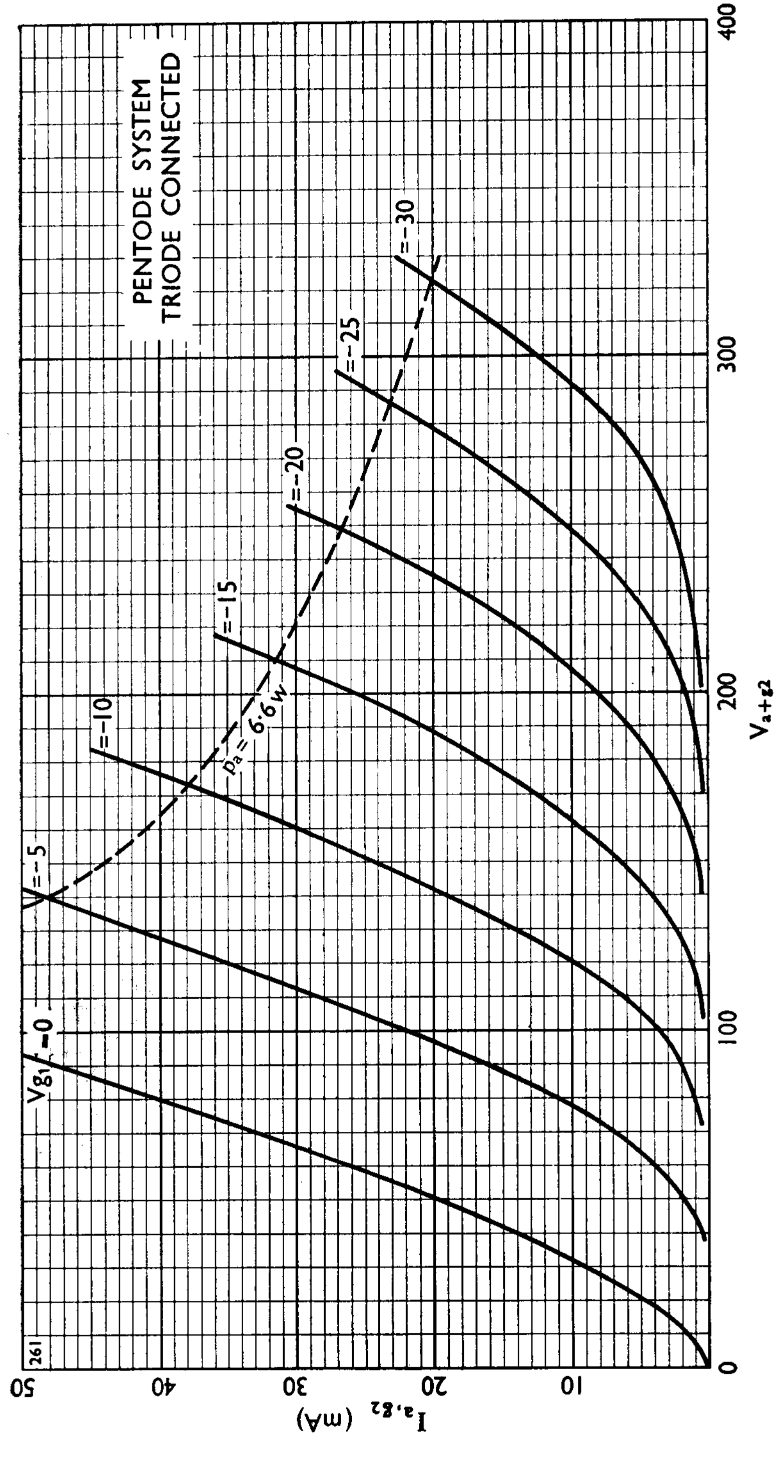
Free air circulation is preferable. If a retaining device in the form of a canister is employed, its surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 200°C.


PENTODE SYSTEM
Vg2 = 165
Vg1 = 0
= −4·5
= −9
= −13·5
= −18
pa = 5·4W
Ig2 at Vg1 = −9
Va
0
100
200
300
400
Ia & Ig2 (mA)
25
50
75
100
263

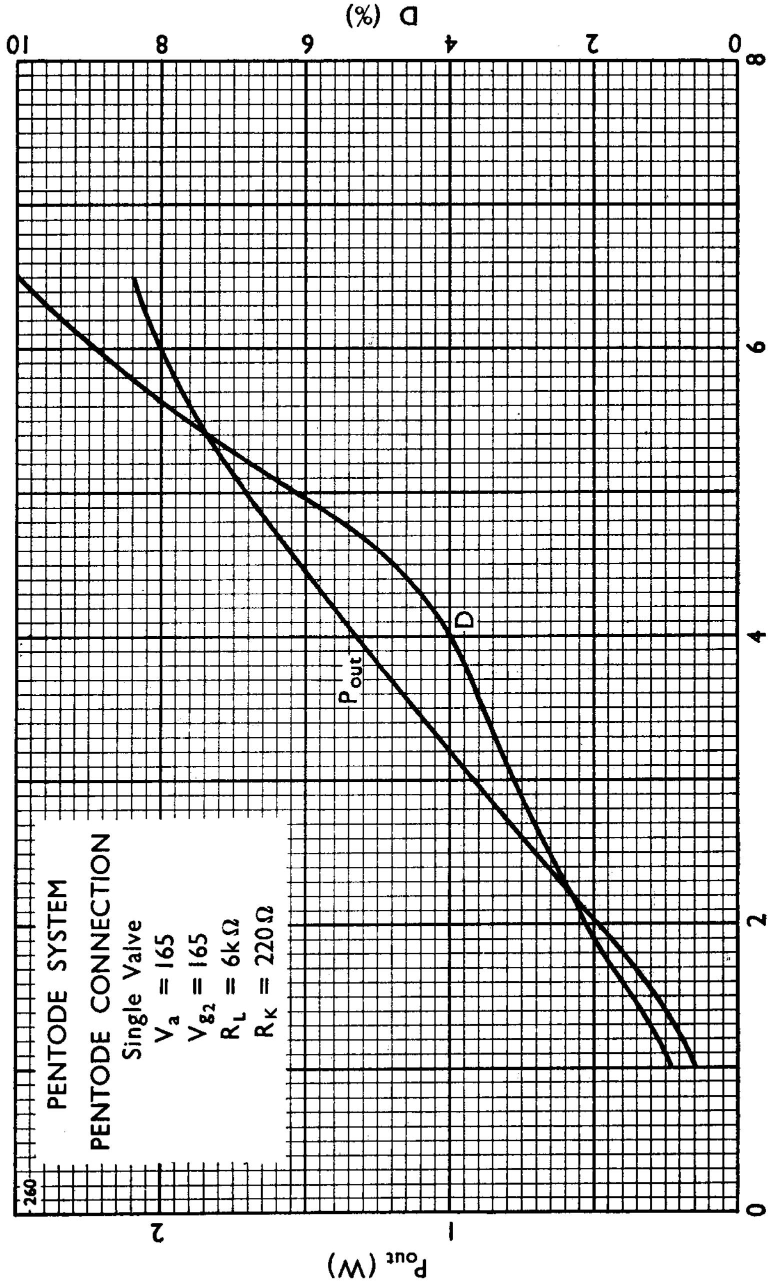
LN309

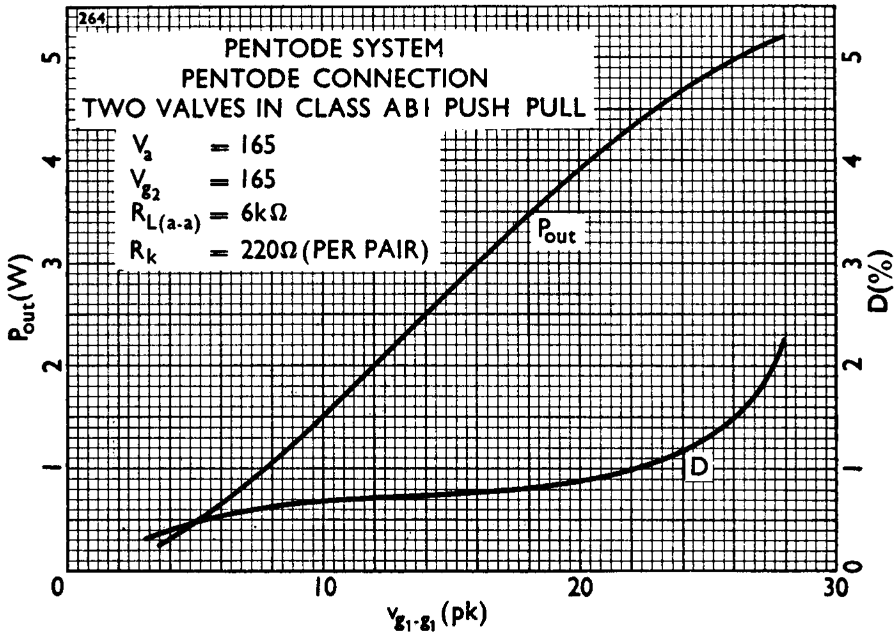


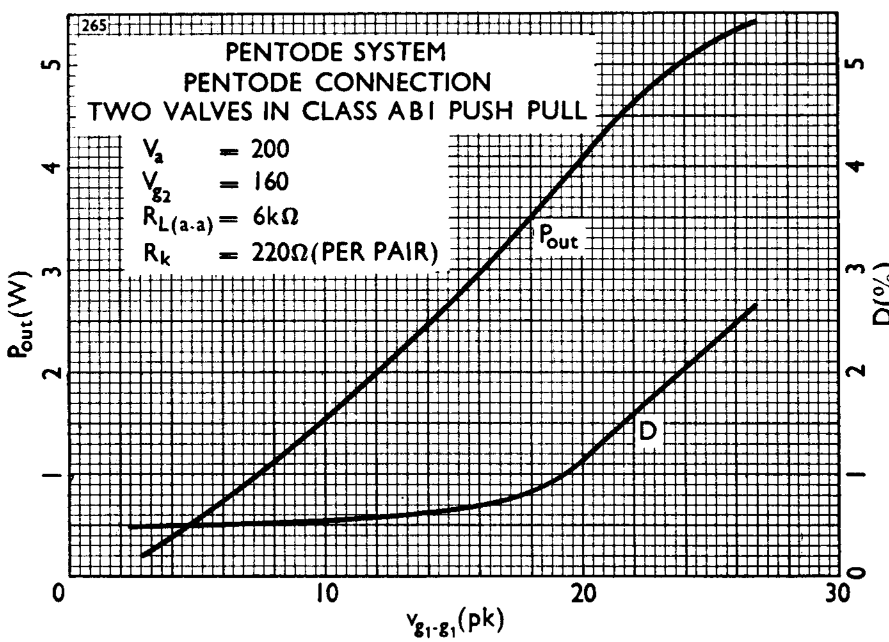
PENTODE SYSTEM
$V_{g1} = 0$
$V_{g2} = 165$
=130
=100
$p_a = 5{\cdot}4W$
I_{g2} at $V_{g2} = 165$
=130
=100
V_a
0
100
200
300
400
I_a & I_{g2} (mA)
25
50
75
100
262

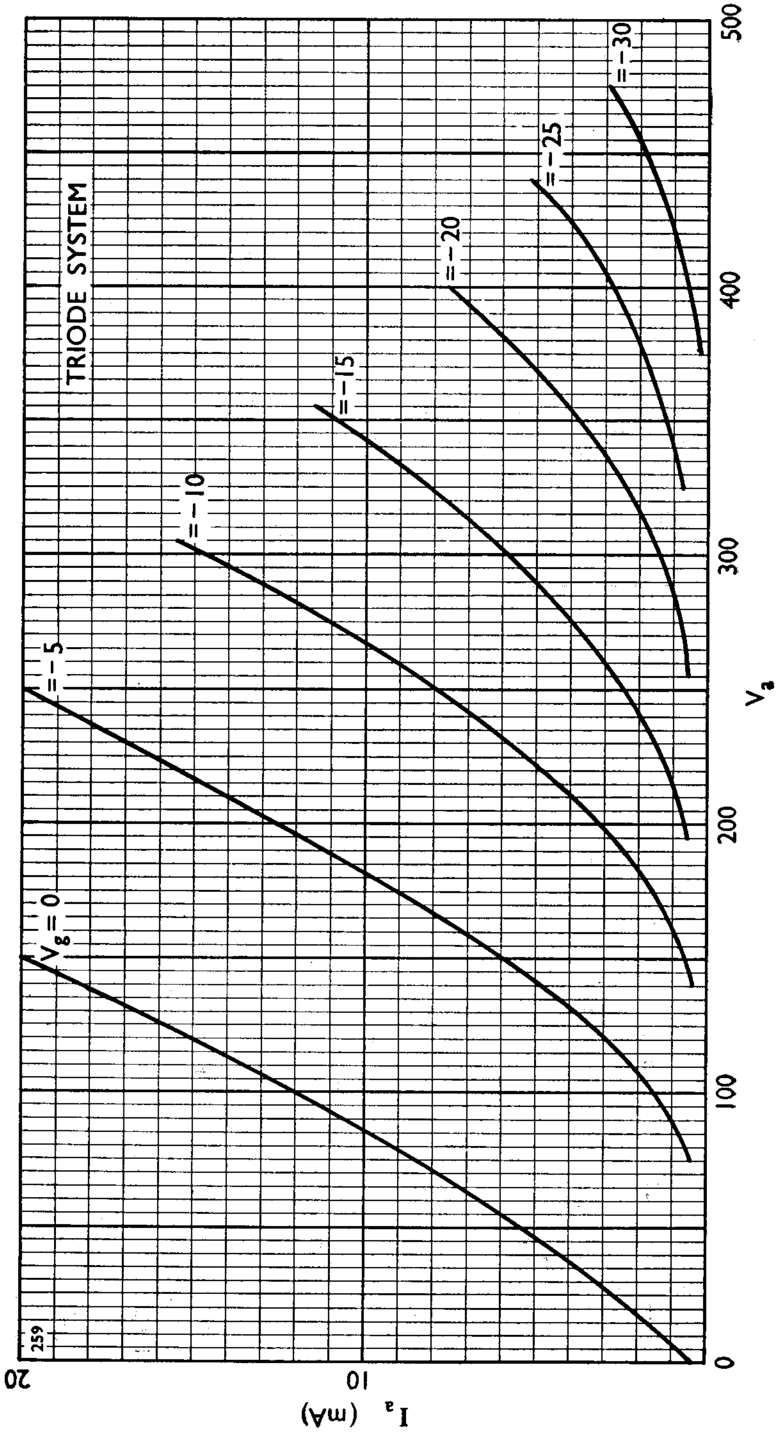

PENTODE SYSTEM
TRIODE CONNECTED
V_{g1} = 0
= −5
= −10
= −15
= −20
= −25
= −30
p_a = 6·6 W
$I_{a,g2}$ (mA)
V_{a+g2}
0
10
20
30
40
50
100
200
300
400

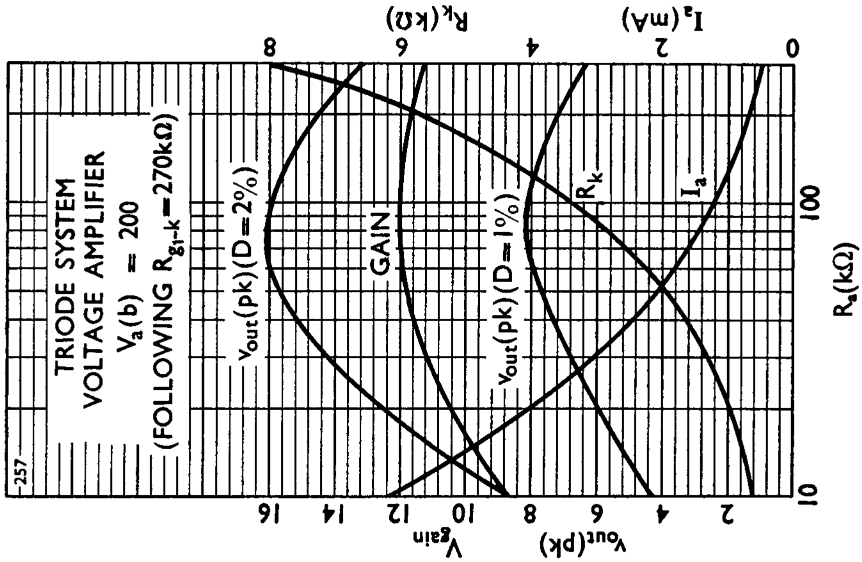
LN309

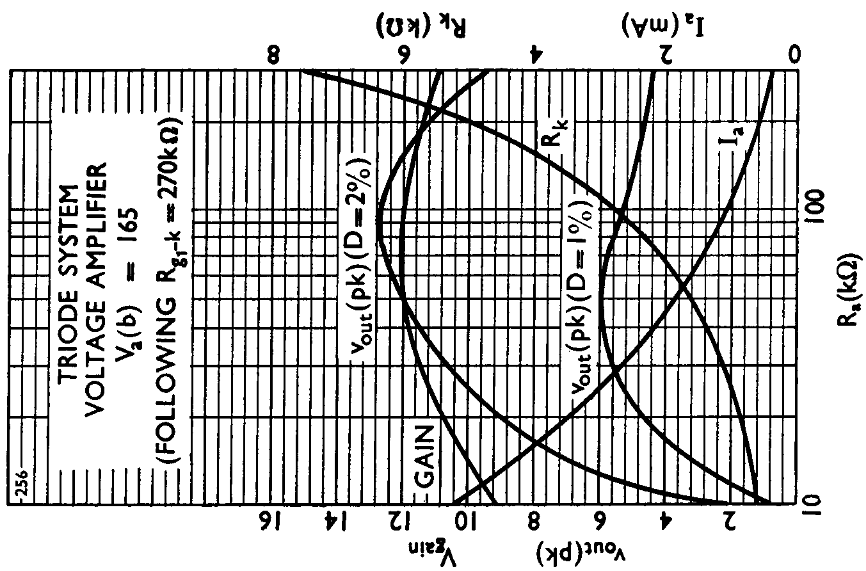

PENTODE SYSTEM
PENTODE CONNECTION
Single Valve
Va = 165
Vg2 = 165
RL = 6kΩ
RK = 220Ω
Pout
D
vg1 (pk)
D (%)
Pout (W)
0
2
4
6
8
10
1
2
260


264
PENTODE SYSTEM
PENTODE CONNECTION
TWO VALVES IN CLASS AB1 PUSH PULL
V_a = 165
V_{g2} = 165
$R_{L(a-a)}$ = 6kΩ
R_k = 220Ω (PER PAIR)
P_{out}
D
P_{out}(W)
D(%)
v_{g1-g1}(pk)
0
10
20
30
1
2
3
4
5

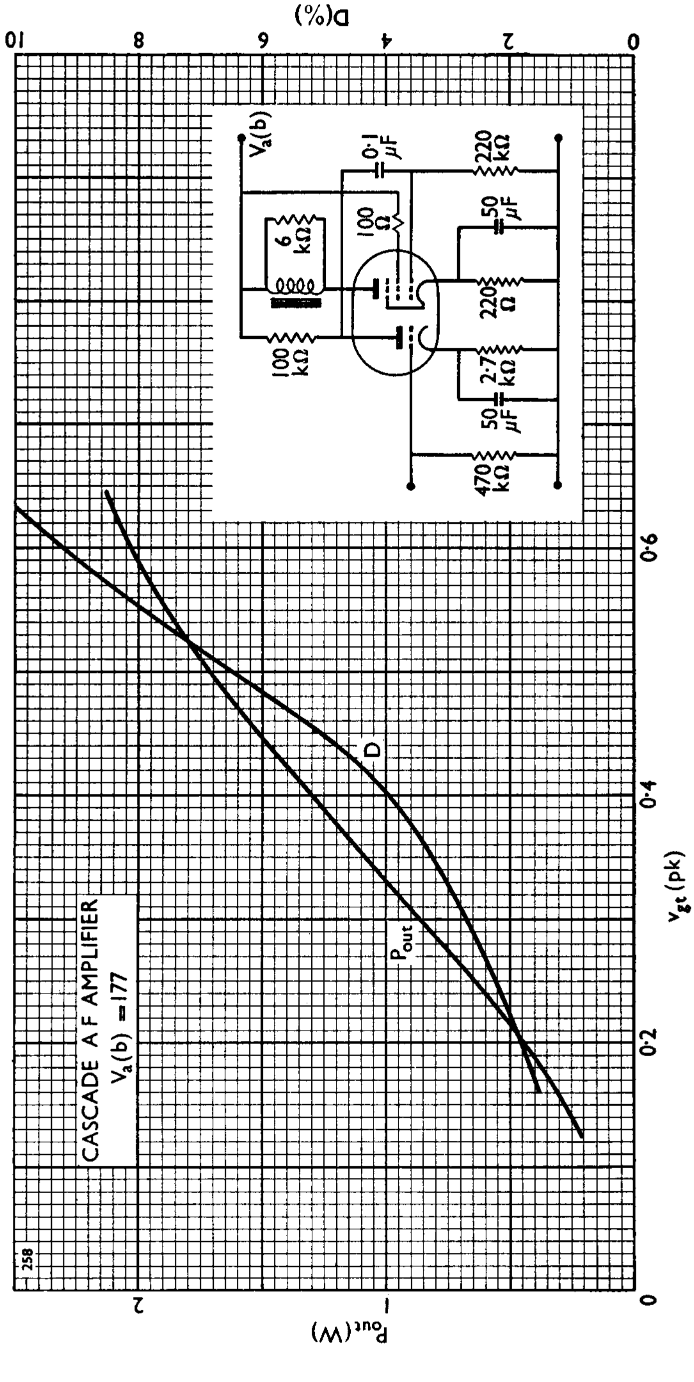

265
PENTODE SYSTEM
PENTODE CONNECTION
TWO VALVES IN CLASS AB1 PUSH PULL
V_a = 200
V_{g2} = 160
$R_{L(a-a)}$ = 6kΩ
R_k = 220Ω (PER PAIR)
P_{out}
D
P_{out}(W)
D(%)
v_{g1-g1}(pk)
0
10
20
30
1
2
3
4
5


TRIODE SYSTEM
$V_g = 0$
= −5
= −10
= −15
= −20
= −25
= −30
V_a
0
100
200
300
400
500
I_a (mA)
20
10
259


TRIODE SYSTEM
VOLTAGE AMPLIFIER
$V_a(b)$ = 200
(FOLLOWING R_{g_1-k} = 270kΩ)
257
$v_{out}(pk)(D=2\%)$
GAIN
$v_{out}(pk)(D=1\%)$
R_k
I_a
$R_a(k\Omega)$
$R_k(k\Omega)$
$I_a(mA)$
V_{gain}
$v_{out}(pk)$
8
6
4
2
0
10
100
16
14
12
10
8
6
4
2


TRIODE SYSTEM
VOLTAGE AMPLIFIER
$V_a(b)$ = 165
(FOLLOWING R_{g_1-k} = 270kΩ)
256
$v_{out}(pk)(D=2\%)$
GAIN
$v_{out}(pk)(D=1\%)$
R_k
I_a
$R_a(k\Omega)$
$R_k(k\Omega)$
$I_a(mA)$
V_{gain}
$v_{out}(pk)$
8
6
4
2
0
10
100
16
14
12
10
8
6
4
2

LN309



CASCADE A F AMPLIFIER
Va(b) = 177
D(%)
0
2
4
6
8
10
Pout(W)
0
1
2
vgt (pk)
0·2
0·4
0·6
D
Pout
Va(b)
0·1 μF
220 kΩ
6 kΩ
100 Ω
50 μF
100 kΩ
220 Ω
2·7 kΩ
50 μF
470 kΩ
258

The rating and characteristics of the LN309 are given in the Technical Data Sheet.

The LN309 is suitable for many classes of operation, more general uses being :—

	Pentode	Triode
1.	Audio output	1st Audio stage
2.	Frame output	Frame oscillator
3.	Sync. separator	Line oscillator

AUDIO AMPLIFICATION

As an audio amplifier an output of 2 watts is obtainable, adequate for television receivers or for the smaller table radio sets. Where a greater output is required two valves may be employed to give output of the order of 5·5 watts. The two triodes then perform as first audio and phase inverting stages. An input voltage to the triode grid of less than 0·5 volt r.m.s. will provide full output in both cases.

Typical circuits are shown in Figures 1 and 2. That shown in fig. 2 uses a self-balancing arrangement which is capable of providing the inputs for the two pentodes with a phase difference of 180°. Small differences in triode characteristics have no effect on the circuit performance.

The use of separate cathodes for the pentode and triode sections prevents instability. A bias capacitor is necessary to give minimum distortion in the pentodes, but it may be omitted from the triode cathodes unless hum is experienced due to a high A.C. heater to cathode voltage.

FRAME TIME-BASE APPLICATIONS

As a frame oscillator and output valve sufficient scanning power should be available for 70° tubes operating up to 12 kV, assuming that an efficient transformer and scanning coils are used.

SYNC. SEPARATION

As a sync. separator the pentode section of the LN309 operates satisfactorily with a low screen voltage of the order of 10/20 volts. A suitable circuit is shown in fig. 3. The triode section is not shown, it being presumed that this will be used as the line oscillator. The characteristics are such that it will work with normal components and provide sufficient output to drive the line output stage.

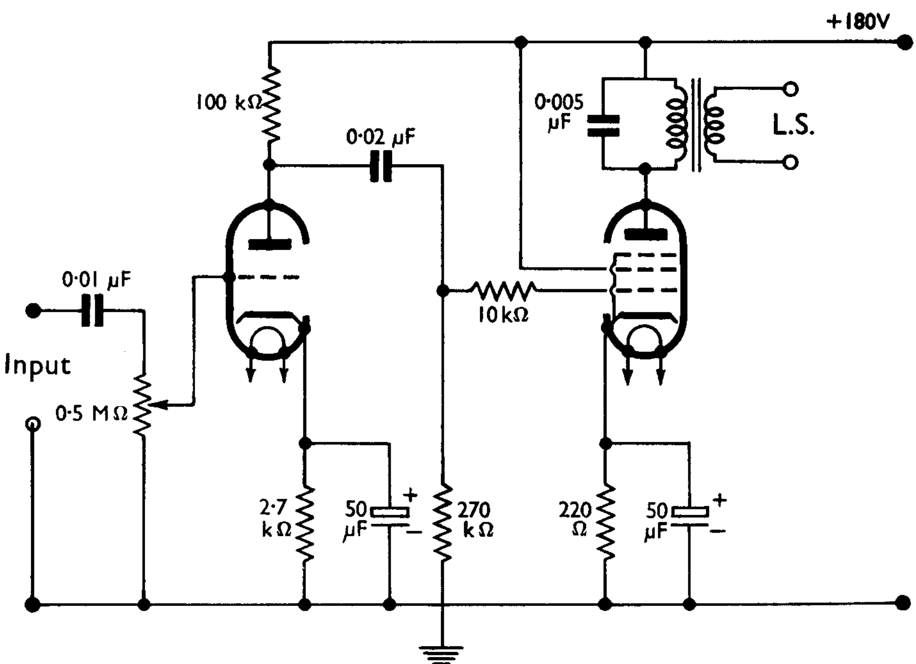


FIG. 1. Two stage audio amplifier.

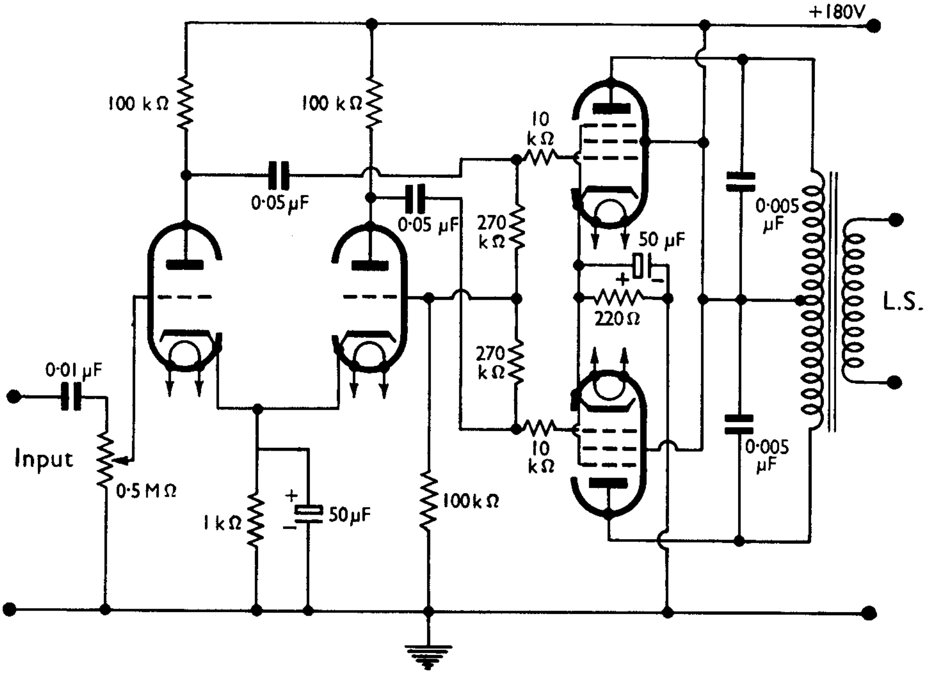


FIG. 2. Push-pull amplifier.

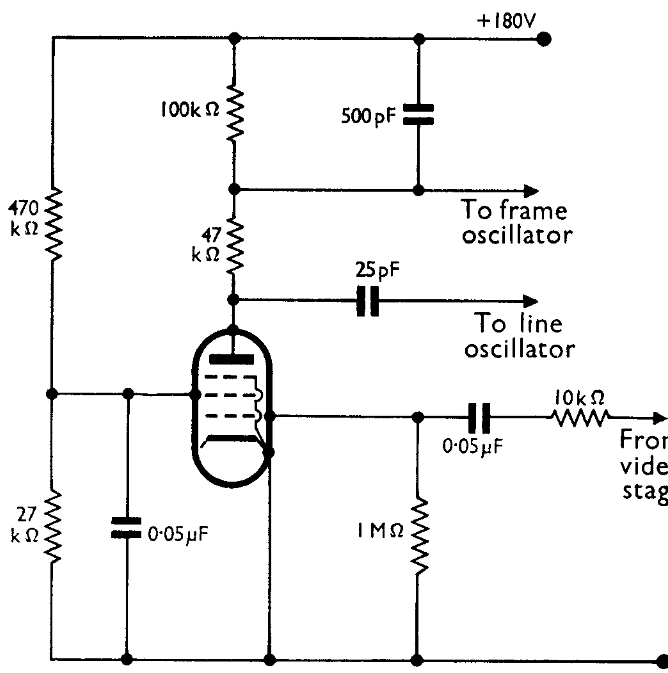


FIG. 3.
Pentode section as sync. separator.

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